Adaptive EMI Mitigation for Enhanced Spacecraft Telecom (Adaptive EMI Mitigation)

Completed Technology Project (2016 - 2018)

Project Introduction

Almost all of the science data from NASA's Mars rovers is returned via a relay link from the surface to a Mars Orbiter. For operational simplicity these relay links use omni directional antennas. This setup leaves telecom systems suceptible to RF interference emenating from near by science payloads and spacecraft subsystems that can decrease link performance by a factor of 2 or more. Most of this interference appears as Fourier overtones of switching power supplies, data lines, clocks, and stepper motors.

Most of the self-generated Electromagnetic interference (EMI) on a spacecraft appears as Fourier overtones of switching power supplies, data lines, clocks, and stepper motors. These EMI tones are relatively stable in frequency, but the complement of EMI tones can vary as the spacecraft operating mode is changed. The Adaptive EMI Mitigation study is developing computationally efficient algorithms to characterize and eliminate major tone interference that otherwise degrades the performance of data return from the planetary surface to relay orbiters overhead.

Anticipated Benefits

Adaptive EMI mitigation can dramatically increase the performance of science data relay links for current and future planetary surface mission. Current missions include data return from the Mars Exploration Rover and the Mars Science Rover via Mars Orbiters like the Mars Reconnaissance Orbiter, the MAVEN orbiter and the European Trace Gas Orbiter that all carry a NASA JPL relay radio.

Adaptive EMI mitigation may be applied to future planetary surface missions including the Mars 2020 Rover, the proposed Mars Helicopter and the Insight Mars Lander. The technique can also be applied to interference tones received by science instruments. Finally, Adaptive EMI Mitigation is an enabling technology for wireless intra-spacecraft commucations which is itself a potential new technology.

This technology can improve the function NASA telecom relay support to the Space-X Red Dragon mission to Mars.

This technology can improve the performance of relay telecom on any in-situ telecom relay link that employs omni-directional communications.

JPL_IRAD_Activities Project

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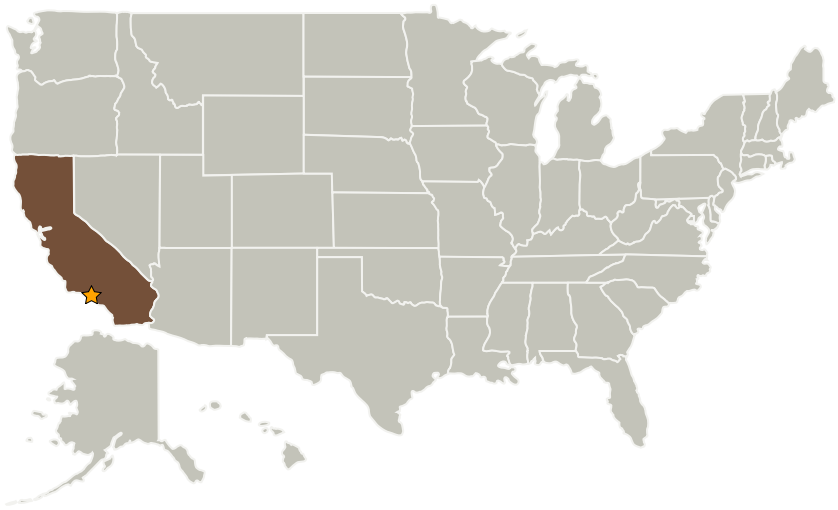
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:

Fred Y Hadaegh

Project Manager:

Fred Y Hadaegh

Principal Investigator:

David J Bell

Co-Investigators:

Curtis Jin
Edgar H Satorius
Matthew D Thill
Zaid Towfic
William D Wu

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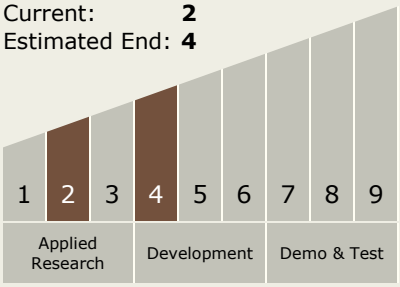
Images

JPL_IRAD_Activities Project Image
JPL_IRAD_Activities Project
(https://techport.nasa.gov/image/27781)

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **4**



Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.3 Avionics Tools, Models, and Analysis
    - TX02.3.4 Electromagnetic Environment Effects

Target Destinations

Mars, Foundational Knowledge

Supported Mission Type

Push